FIG. 1

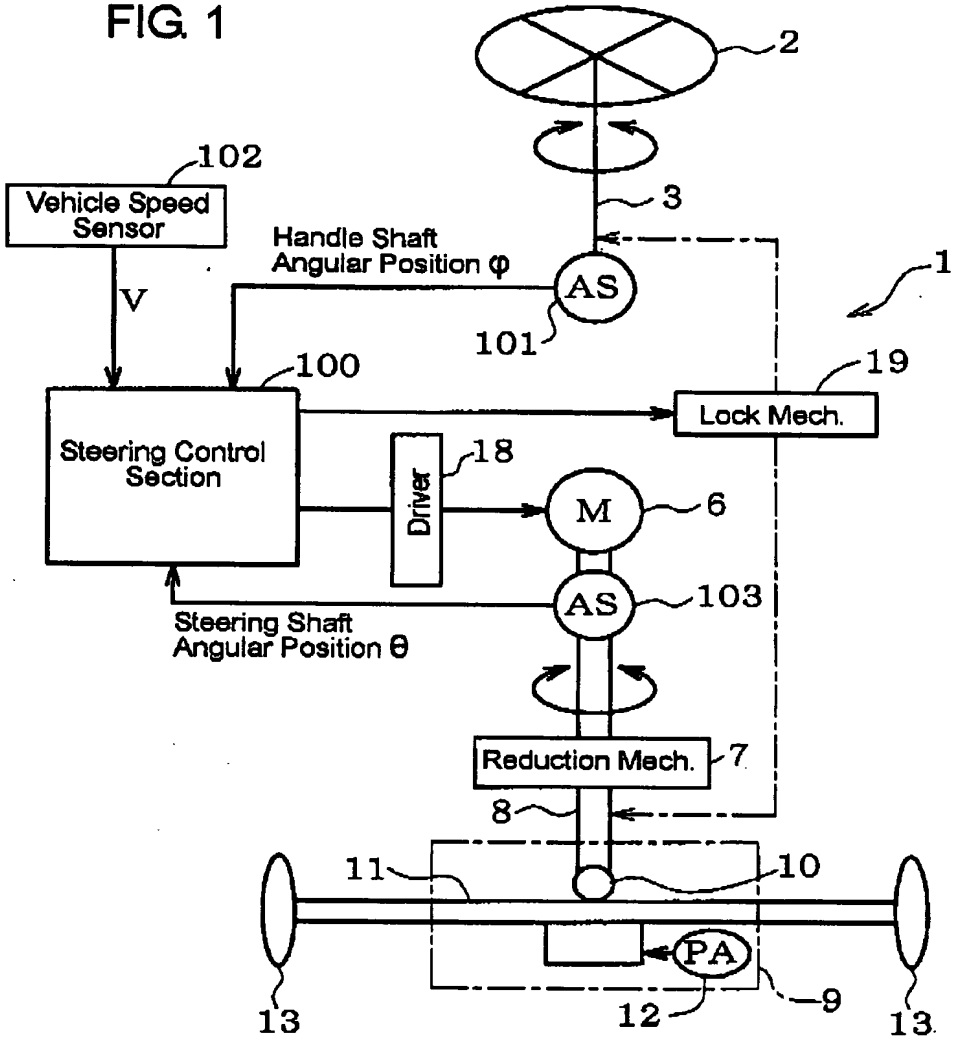

2
102
Vehicle Speed Sensor
3
Handle Shaft Angular Position φ
AS
1
V
101
100
19
Lock Mech.
Steering Control Section
18
Driver
M
6
AS
103
Steering Shaft Angular Position θ
Reduction Mech.
7
8
11
10
PA
9
13
12
13

FIG. 2

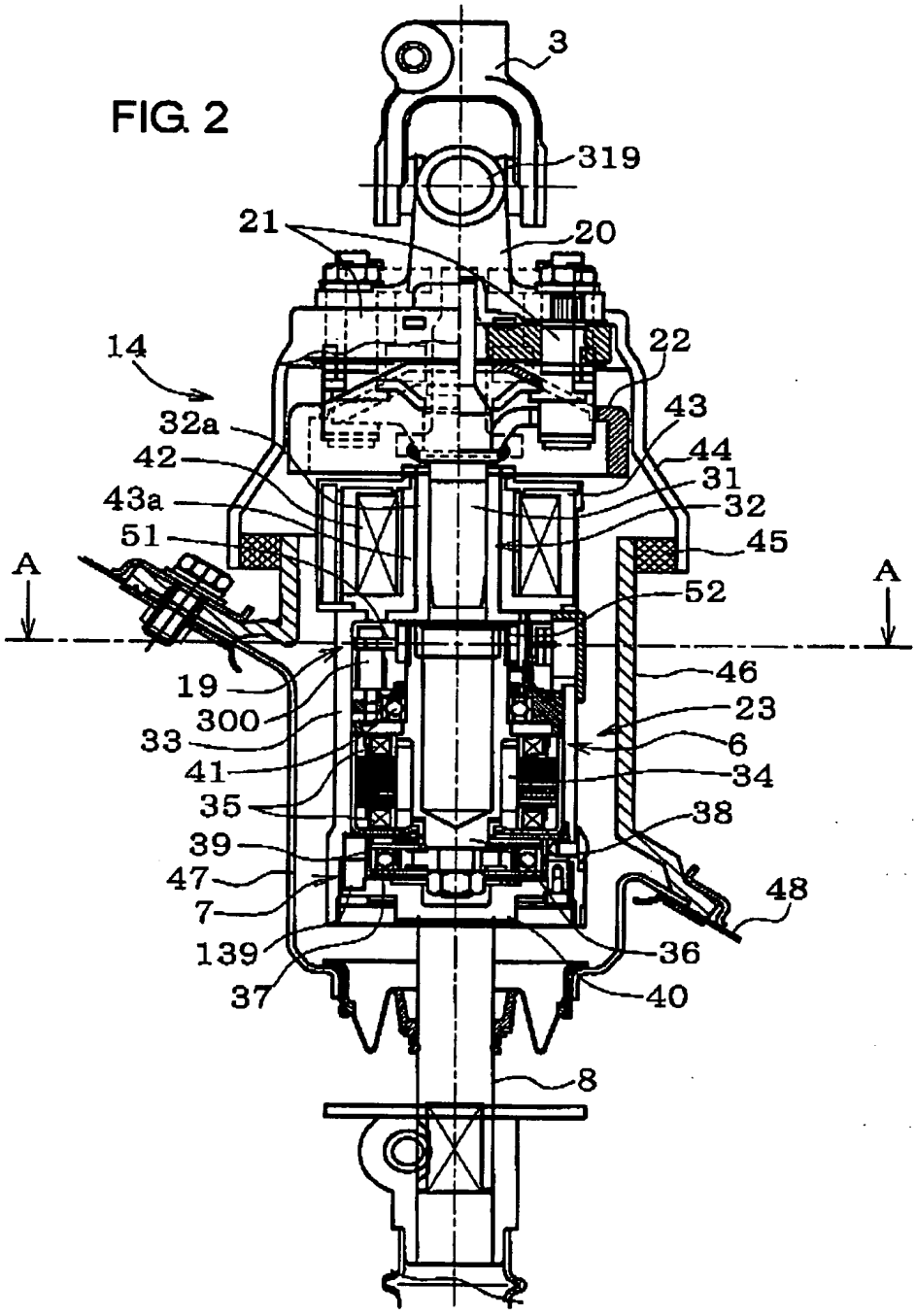

3
319
21
20
14
22
43
32a
44
42
31
43a
32
51
45
A
A
52
46
19
23
300
6
33
34
41
38
35
39
48
47
7
36
139
40
37
8

FIG. 3

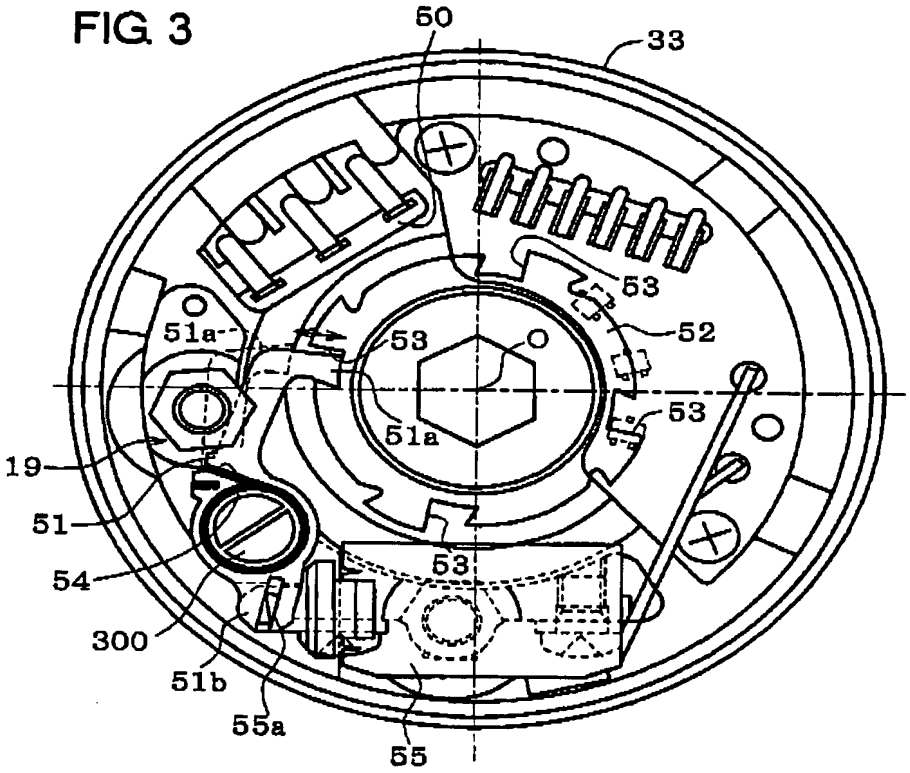


FIG. 4

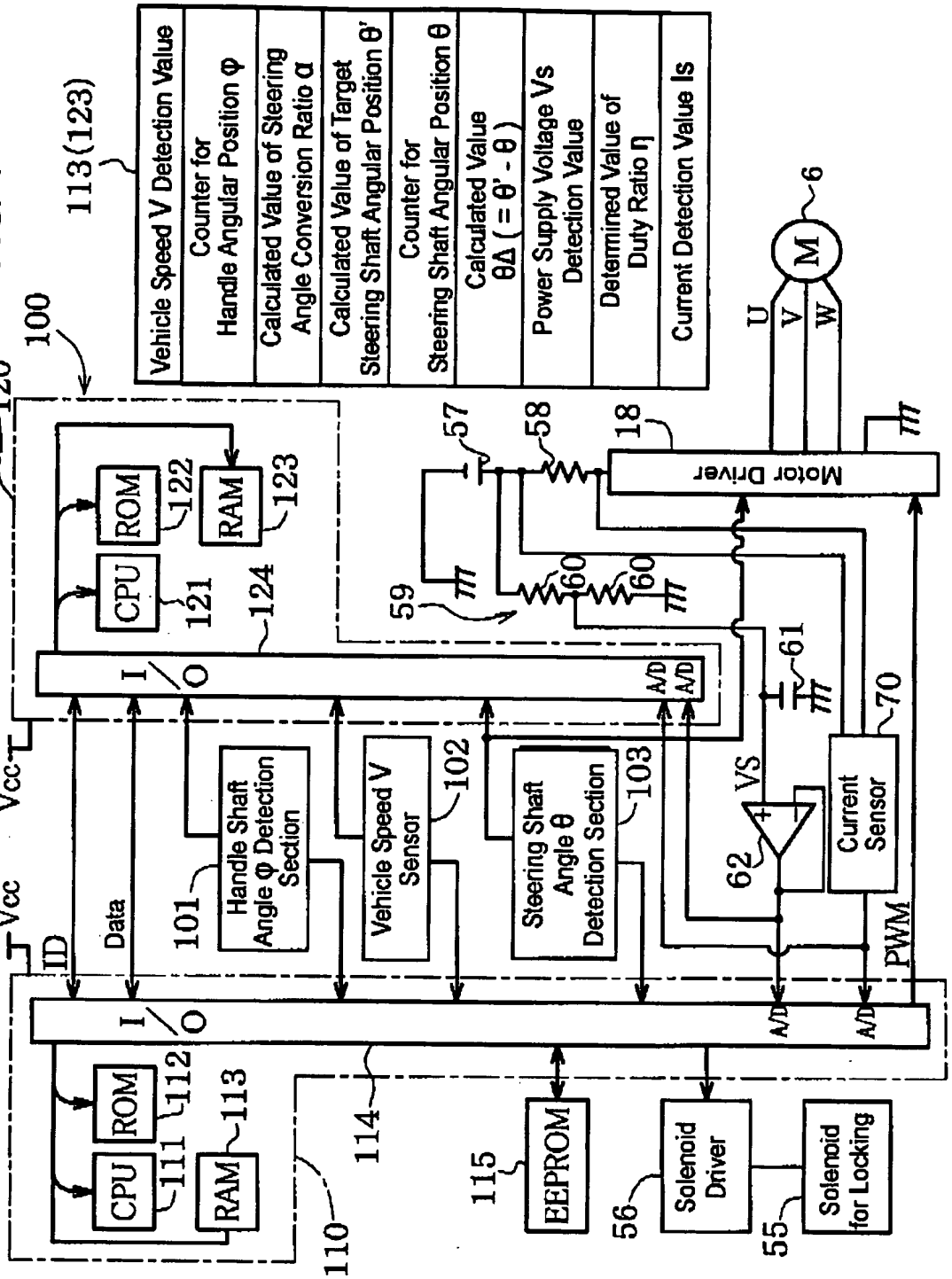

113(123)
Vehicle Speed V Detection Value
Counter for Handle Angular Position φ
Calculated Value of Steering Angle Conversion Ratio α
Calculated Value of Target Steering Shaft Angular Position θ'
Counter for Steering Shaft Angular Position θ
Calculated Value θΔ (= θ' - θ)
Power Supply Voltage Vs Detection Value
Determined Value of Duty Ratio η
Current Detection Value Is
100
120
ROM
122
RAM
123
CPU
121
124
I
O
A/D
Vcc
Data
ID
101
Handle Shaft Angle φ Detection Section
Vehicle Speed V Sensor
102
Steering Shaft Angle θ Detection Section
103
57
58
18
Motor Driver
59
60
61
70
VS
62
Current Sensor
PWM
6
M
U
V
W
110
111
112
113
114
115
EEPROM
56
Solenoid Driver
55
Solenoid for Locking

FIG. 5

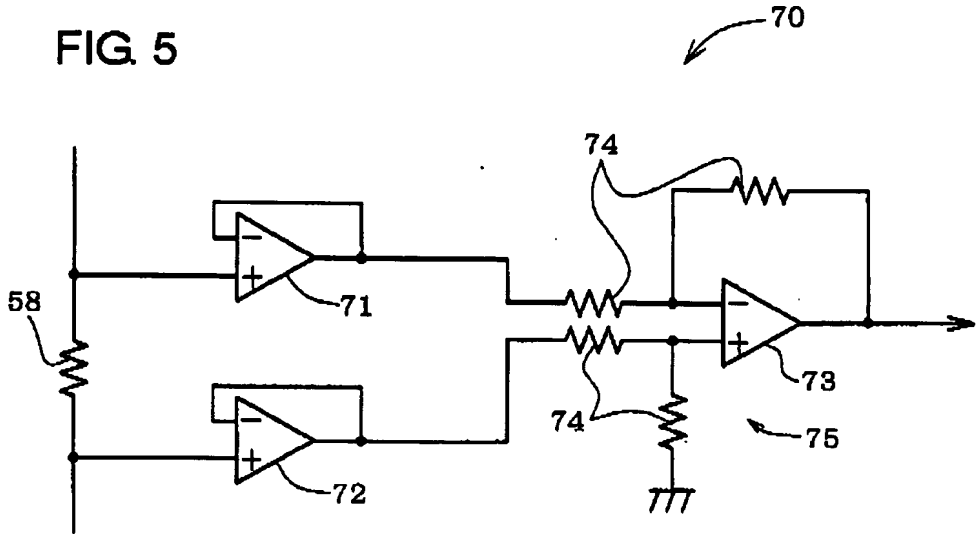

70
74
58
71
73
74
75
72

FIG. 6

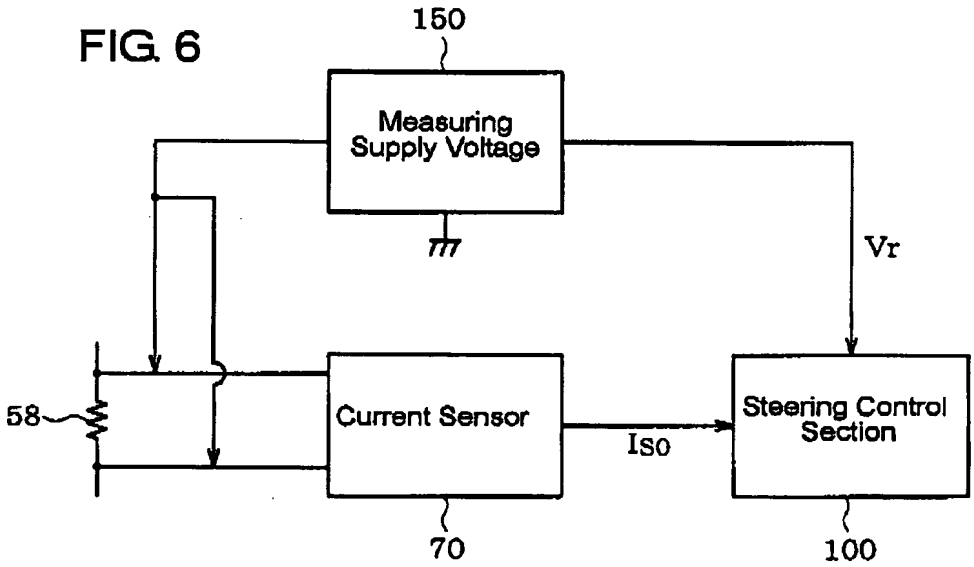

150
Measuring Supply Voltage
Vr
58
Current Sensor
Iso
Steering Control Section
70
100

FIG. 7

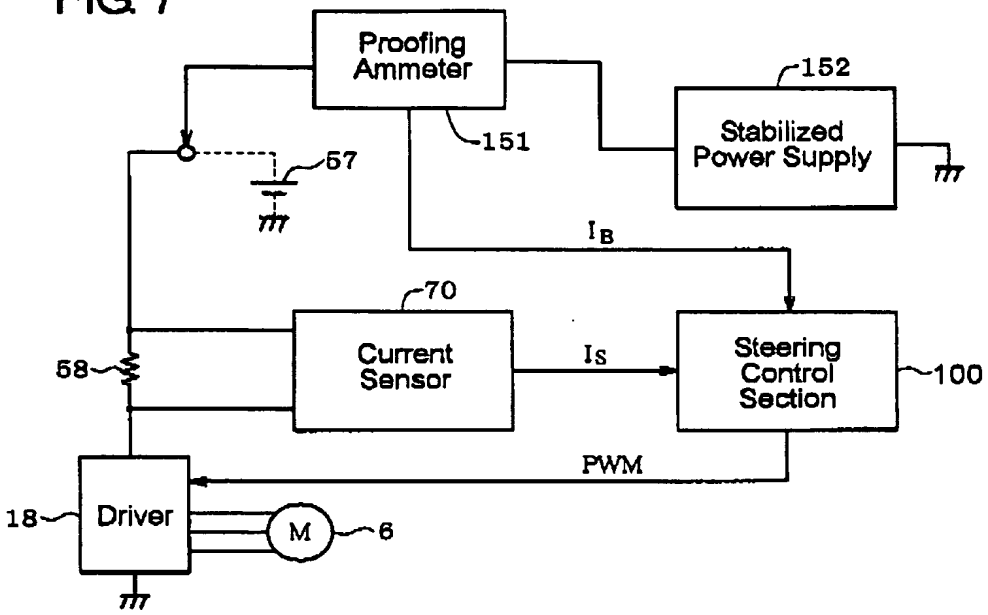


FIG. 16

$$E_{0X}=G_0\cdot(V_X-V_2)+E_{02}$$
$$C=E_{02}-G_0\cdot V_2$$

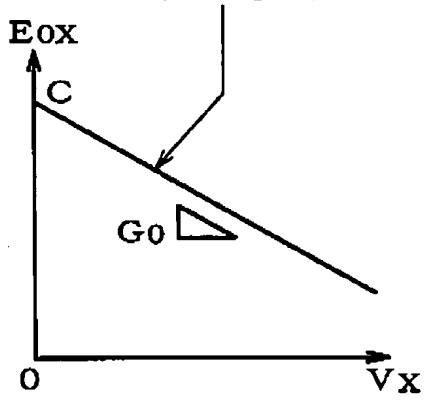


FIG. 8

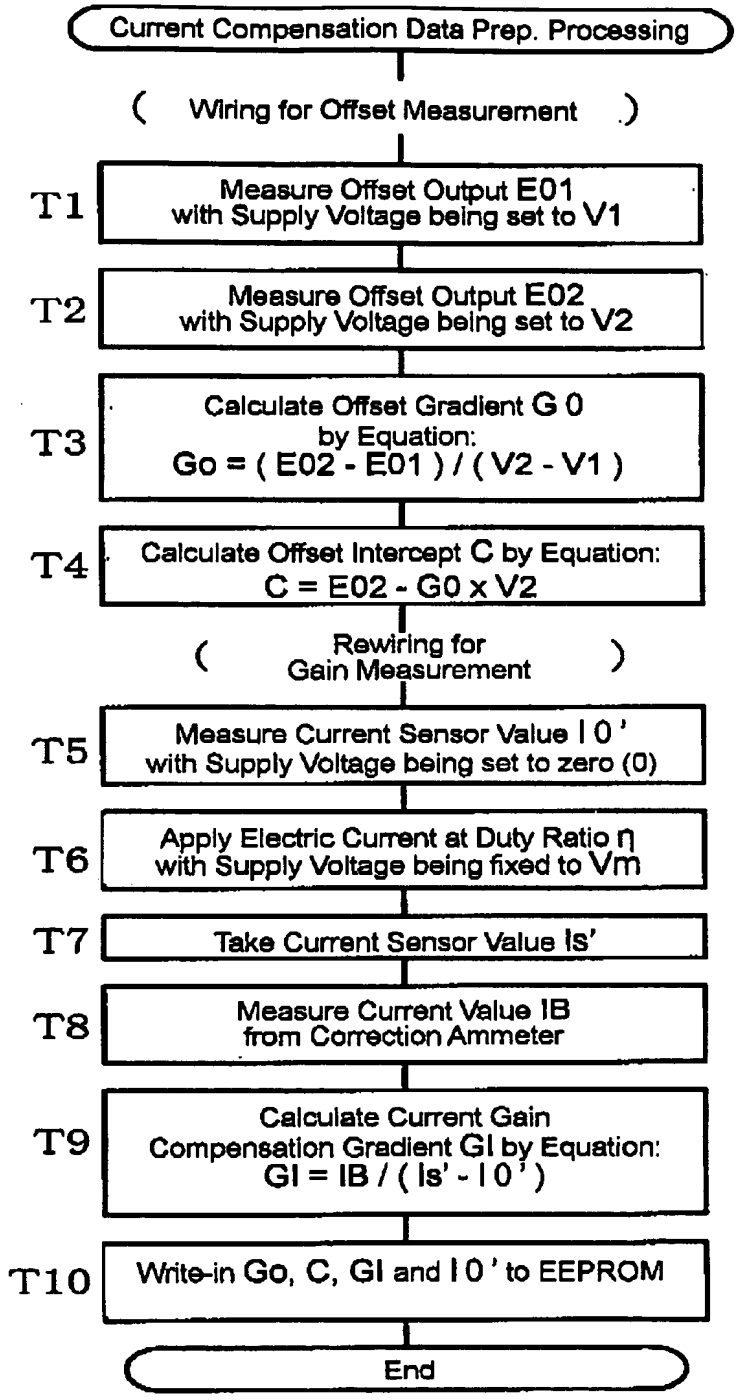

Current Compensation Data Prep. Processing
(Wiring for Offset Measurement)
T1
Measure Offset Output E01 with Supply Voltage being set to V1
T2
Measure Offset Output E02 with Supply Voltage being set to V2
T3
Calculate Offset Gradient G 0 by Equation: Go = (E02 - E01) / (V2 - V1)
T4
Calculate Offset Intercept C by Equation: C = E02 - G0 x V2
(Rewiring for Gain Measurement)
T5
Measure Current Sensor Value I 0 ' with Supply Voltage being set to zero (0)
T6
Apply Electric Current at Duty Ratio η with Supply Voltage being fixed to Vm
T7
Take Current Sensor Value Is'
T8
Measure Current Value IB from Correction Ammeter
T9
Calculate Current Gain Compensation Gradient GI by Equation: GI = IB / (Is' - I 0 ')
T10
Write-in Go, C, GI and I 0 ' to EEPROM
End

FIG. 9

130

Vehicle Speed (V)	V_1	V_2	V_3	.....	V_n
Steering Angle Conversion Ratio (α)	α_1	α_2	α_3	.....	α_n

$\alpha = \theta / \varphi$

φ : Handle Shaft Angular Position

θ : Steering Shaft Angular Position

FIG. 10

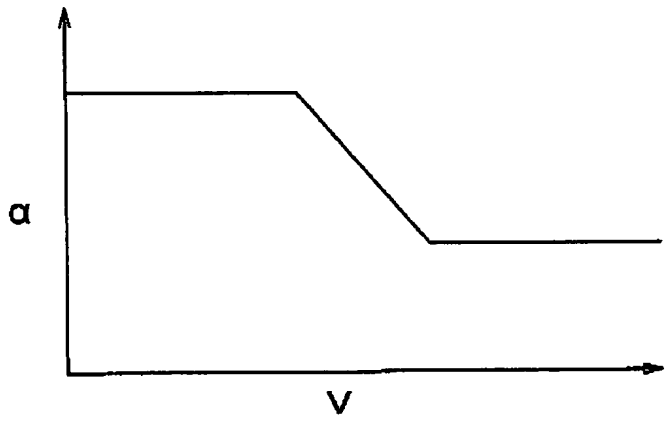


FIG. 11

131

$\Delta\theta$ \ Vs	Vs_1	Vs_2	Vs_3	Vs_4	・・・	Vs_n
$\Delta\theta_1$	η_{11}	η_{12}	η_{13}	η_{14}	・・・	η_{1n}
$\Delta\theta_2$	η_{21}	η_{22}	η_{23}	η_{24}	・・・	η_{2n}
$\Delta\theta_3$	η_{31}	η_{32}	η_{33}	η_{34}	・・・	η_{3n}
$\Delta\theta_4$	η_{41}	η_{42}	η_{43}	η_{44}	・・・	η_{4n}
⋮	⋮	⋮	⋮	⋮	⋮	⋮
$\Delta\theta_m$	η_{m1}	η_{m2}	η_{m3}	η_{m4}	・・・	η_{mn}

η : Duty Ratio

$\Delta\theta = \theta' - \theta$

θ' : Target Steering Shaft Angular Position

θ : Present Steering Shaft Angular Position

FIG. 12

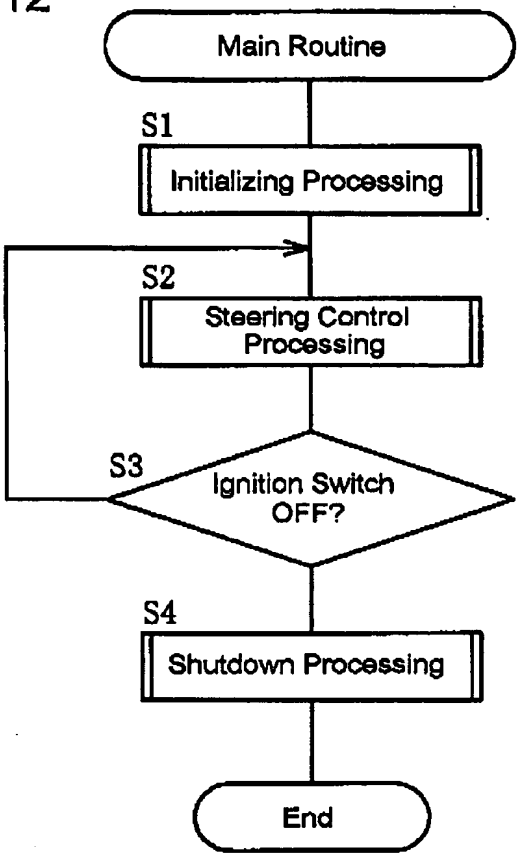

Main Routine
S1
Initializing Processing
S2
Steering Control Processing
S3
Ignition Switch OFF?
S4
Shutdown Processing
End

FIG. 13

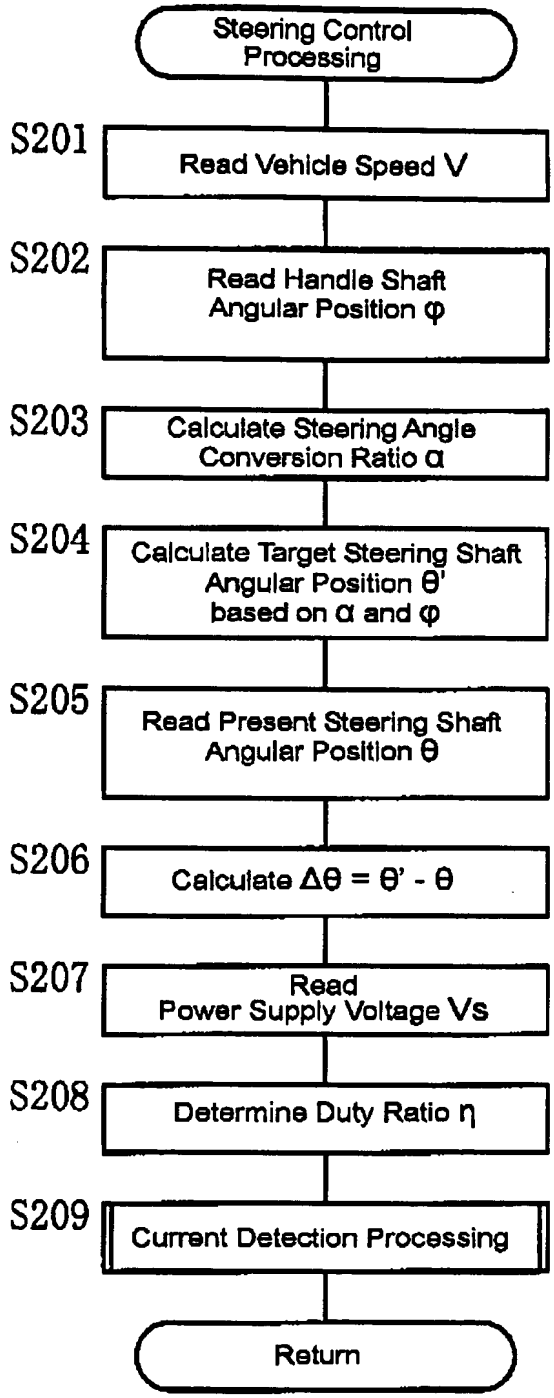

Steering Control Processing
S201
Read Vehicle Speed V
S202
Read Handle Shaft Angular Position φ
S203
Calculate Steering Angle Conversion Ratio α
S204
Calculate Target Steering Shaft Angular Position θ' based on α and φ
S205
Read Present Steering Shaft Angular Position θ
S206
Calculate Δθ = θ' - θ
S207
Read Power Supply Voltage Vs
S208
Determine Duty Ratio η
S209
Current Detection Processing
Return

FIG. 14

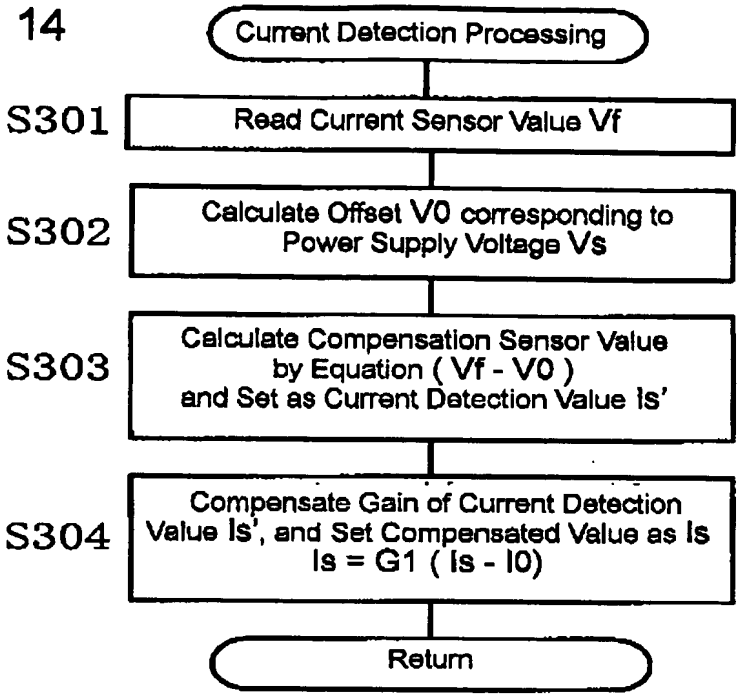
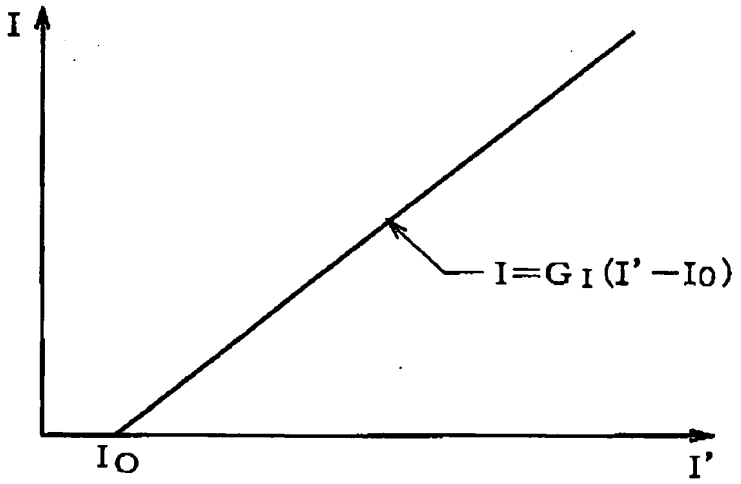

Current Detection Processing
S301
Read Current Sensor Value Vf
S302
Calculate Offset V0 corresponding to Power Supply Voltage Vs
S303
Calculate Compensation Sensor Value by Equation (Vf - V0) and Set as Current Detection Value Is'
S304
Compensate Gain of Current Detection Value Is', and Set Compensated Value as Is
Is = G1 (Is - I0)
Return

FIG. 15


I
I=G I (I' −Io)
Io
I'